DOCUMENT RESUME

ED 184 889 SE 030 570

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TITLE An Analysis and Comparison of Elementary Pre-Service and In-Service Teacher's Beliefs About Science Teachers Classroom Behaviors.
PUB DATE Apr 80
NOTE 23p.: Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (53rd, Boston, MA, April 11-13, 1980).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Elementary School Teachers: Higher Education: Inservice Teacher Education: Preservice Teacher Education: Science Education: *Science Teachers: *Teacher Attitudes: *Teacher Behavior
IDENTIFIERS *Science Education Research

ABSTRACT

Reported is a study to identify specific science teacher types among elementary preservice and inservice teachers. The results state that similar science teacher types were identified in both samples and the types were found to correspond closely with types previously identified for junior and senior high school science teachers. (SA)

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AN ANALYSIS AND COMPARISON OF ELEMENTARY PRE-SERVICE AND IN-SERVICE TEACHER'S BELIEFS ABOUT SCIENCE TEACHERS CLASSROOM BEHAVIORS

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Presented at the 53rd Annual Meeting of the National Association For Research in Science Teaching,

April 11-13, 1980, in Boston, Massachusetts

SE 030 570

AN ANALYSIS AND COMPARISON OF ELEMENTARY PRE-SERVICE AND IN-SERVICE TEACHER'S BELIEFS ABOUT SCIENCE TEACHER CLASSROOM BEHAVIORS

The identification and categorization of teacher's beliefs and behaviors has consistently attracted much attention and research in social psychology and education. Many alternative research procedures have been utilized to study these variables. One method employed has been the coding of teacher's behaviors in the classroom. In many instances these coded behaviors have been used to infer teachers educational beliefs and attitudes. An alternative method has employed the measurement and the categorization of beliefs and attitudes about educational practices. Then these measured beliefs have been used to predict teacher behavior. Studies in this paradigm have been successful in categorizing beliefs and also in predicting future behaviors.

Early research studies by Kerlinger (1956), Ryans and Wandt (1952), and Gibb (1955) have suggested that there are common groups or dimensions of behaviors and beliefs about education practice. Wehling and Charters (1969) later identified eight dimensions of teacher's beliefs that were not unique to particular populations, and Sontag (1968) analyzed the dimensions of teachers' perceptions of classroom behavior and identified four recognizable factors in various teacher samples. In the area of science education, recent studies by Bybee (1975, 1978) and by Horak and Lunetta (1979) have been reported. These studies have

generally shown that groups of science teaching behaviors may be prioritized and that types of science teachers may be identified relative to their beliefs about the importance of specific science teacher behaviors in the classroom. Additionally these research studies were able to delineate teachers' patterns of belief related to attitudinal statements on teaching. These patterns have shown that unidimensional continuums such as direct-indirect, integrative-dominative, or concrete-abstract, do not accurately reflect the complex mature and interactions of teachers' belief systems.

The main objective of this study was to see if specific science teacher types could be identified among elementary in-service and pre-service teachers. Additionally these science teacher types for each sample were analyzed for their correlation with previously reported teacher types identified in junior and senior high school science teachers.

Procedures

Instrument. The instrument used in this study was the Science Classroom Behavior Q-sort. This instrument has reported content validity and test-retest reliability of 0.810 (Horak and Lunetta, 1979). The instrument contains belief statements in eight categories which describe types of teacher behaviors that have been systematically observed and reported. The eight categories include: Warmth; Indirectness; Social System; Discipline; Knowledge; Management; Communication;

and Flexibility. Each statement is written in a positive and desireable sense.

Data. The sample for this study consisted of 92 pre-service elementary teachers and 62 in-service elementary teachers from a regional area. In Q-methodology selection of the participants is not usually done randomly, but rather they are chosen to represent identifiable divisions of the population with which the study is concerned. For this study, background characteristics and grade preferences of the participants were used to help identify relevant segments of the teacher population. Subjects were asked to sort the 80 behavioral statements into a quasi-normal distribution according to their beliefs about the importance of the classroom behaviors for teaching in the elementary school. The sort formed an eleven point continuum of behaviors from most-important to least-important as viewed by each participating in-service or pre-service teacher.

Analysis. The data were analyzed according to Q-analysis procedures described and developed by Stephenson (1953) which treated teachers as variables and the ordering of behavioral statements as observations. First a Pearson product-moment correlation matrix was produced from the data by correlating each teacher's statement sort with every other teacher's sort. The correlation matrix was evaluated for principal component factors and the obtained factors were rotated according to a varimax procedure. The rotated factor matrix was

reordered, classifying each teacher according to his or her highest factor loading. The variables were then assigned a weight according to the following formula:

$$W = \frac{r}{1 - r^2}, \text{ where}$$

W = weight, and r = highest factor loading.

The pattern of statement order associated with each factor was estimated. This was done by weighting each statement based upon its ranking by teachers most highly associated with a given factor, and then standardizing and converting to z-scores the weighted item arrays for each factor. Lastly the z-scores were used to compare and differentiate the factor descriptions.

Results

The Q-factor analysis identified four distinct factors or science teacher groups in both the pre-service and the in-service samples. Table 1 lists the Pearson product-moment correlations for the factors as determined by the correlation of the weighted item arrays for each type. The statistics show that overall the pre-service teachers shared more similar beliefs than did the in-service teachers.

INSERT TABLE 1 HERE

Descriptions of the belief patterns of the identified teacher groups follow.

Pre-Service Group 1. This group included 11 teachers and accounted for 19% of the common factor variance. Table 2 shows the items which received the highest degree of acceptance and also the items which best distinguish this groups beliefs from all other teachers.

INSERT TABLE 2 HERE

Group 1 pre-service teachers tended to stress indirectness and warmth items. Of the 12 statements receiving z-scores of 1.0 or above, nine came from these categories. These items were also the ones Group 4 pre-service teachers ranked higher. However, Group 1 and Group 4 pre-service teachers could be differentiated by their views about knowledge and the science curriculum. Group 1 felt more strongly that teachers should be sure students are thoroughly grounded in the facts and knowledge about the subject while Group 4 teachers felt that teachers should fit the curriculum to the child and not the child to the curriculum.

Pre-Service Group 2. This group included 29 teachers and accounted for 27% of the common factor variance. Table 3 shows the items which received the highest degree of acceptance and also those items which best distinguished this groups' beliefs from all other teachers.

INSERT TABLE 3 HERE

Group 2 pre-service teachers could best be identified by their views on knowledge and the curriculum. Of the 13 statements receiving z-scores of 1.0 or above, 5 came from the knowledge category. They also felt strongly that teachers should integrate course content across subjects.

Pre-Service Group 3. This group included 14 teachers and accounted for 16% of the common factor variance. Table 4 shows the items which received the highest degree of acceptance and also those items which best distinguished this groups' beliefs from all other teachers.

INSERT TABLE 4 HERE

This group had quite a complex belief system. Of the 13 statements receiving z-scores of 1.0 or above, three each came from the categories indirectness and warmth, two came from the category of flexibility and one each came from the categories of knowledge, discipline, social system, management, and communication.

Pre-Service Group 4. This group contained 38 teachers and accounted for 38% of the common factor variance. Table 5 shows the items which received the highest degree of acceptance and also those items which best distinguished this groups' beliefs from all other teachers.

INSERT TABLE 5 HERE

This group had a belief system quite similar to Group 1 teachers. However, their belief system was more consistent with ideals espoused by humanistic psychologists in all the eight categories. They also rated the discipline item teachers should let discipline be governed by well established standards much lower than did the other 3 groups.

In-Service Group 1. This group contained 33 teachers and accounted for 43% of the common factor variance. Table 6 shows the items which received the highest degree of acceptance and also those items which best distinguished this groups' belief from all other teachers.

INSERT TABLE 6 HERE

This group ranked items in the indirectness category higher than did any of the other groups. They also felt more strongly that teachers should fit the curriculum to the child and not the child to the curriculum. Their low ranking of items concerning discipline and classroom management also helped to differentiate this group of teachers.

In-Service Group 2. This group contained 15 teachers and accounted for 15% of the common factor variance. Table 7 shows the items which received the highest degree of acceptance and also those items which best distinguished this groups' beliefs from all other teachers.

INSERT TABLE 7 HERE

Overall this group may most easily be identified by their belief that teachers should view education as consisting mainly of arranging learning so that a child gradually builds up a system of knowledge he can use in the future. They also may be identified by their view that teachers should let discipline be governed by well established standards and that teachers should insist that a child obey the teacher.

In-Service Group 3. This group contained 6 teachers and accounted for 16% of the common factor variance. Table 8 shows the items which received the highest degree of acceptance and also those which best distinguished this groups' beliefs from those of all other teachers.

INSERT TABLE 8 HERE

This group was very similar to the Group 3 pre-service teachers. They ranked items from all eight categories among the 14 items which received z-scores of 1.0 or above. Four items from the communication

category, two items each from the indirectness, management and knowledge categories, and one item each from the discipline, social system, warmth, and flexibility categories were included. This demonstrated a very complex belief system.

In-Service Group 4. This group contained 8 teachers and accounted for 15% of the common factor variance. Table 9 shows the items which received the highest degree of acceptance and also those items which best distinguished this groups beliefs from those of all other teachers.

INSERT TABLE 9 HERE

This group was characterized best by the extremely high ranking of the flexibility item teachers should have the classroom contain many displays and interest centers. This item was ranked approximately 4½ standard deviations above the mean ranking of all the other items. Group 4 teachers also felt that teachers should have the curriculum consist of subject matter to be learned and skills to be acquired.

Discussion

The science teacher types identified in the elementary pre-service and in-service teachers were not as easy to characterize as those previously identified in a junior and senior high school sample. For the latter sample three types were reported (Horak and Lunetta, 1979)

that had belief patterns which were consistent with underlying psychological theories. Teacher Group 3 in both the pre-service and in-service sample seemed to have an eclectic view of education. Additionally as shown by the correlation tables the pre-service teachers had very similar views overall.

This study did not classify teachers along unidimensional continuums, but rather it examined the interactions of teacher's beliefs about classroom behavior in eight different categories. It did point out again that the unidimensional continuum do not accurately reflect the complex nature of teacher's belief systems. Under these continuums teachers appear to hold many conflicting beliefs. Thus these teachers could probably not be identified as direct or indirect, humanities or custodial, and integrative or dominative. It should be noted that this or any classification system is reductionistic since in classifying part of the variance of the sample is lost. Also classification schemes will not ever completely describe teachers. Yet they need to be developed to effectively support research on the interactions between teachers and students and to better understand the precursors of teacher behavior.

Information about teacher belief systems is also important for teacher education institutions. Biddle (1964, p.11) stated, "Prospective teachers can no longer be exposed to some facts about individual differences, some theories about learning, child growth,

and development, and let the entire burden of translating this knowledge into teaching fall upon the student and the student teaching experience." The teacher education institutions need to convey to pre-service teachers how classroom teachers have translated various attitudes from philosophy, sociology, educational foundations, and psychology into patterns of belief which incluence their behavior in the classroom.

Groupings of teachers according to educational beliefs is also of importance to in-service teachers when school systems discuss adoption and implementation of one of the now available science curricula. ESS, SCIS, and S:APA will all probably be used in different manners by all types. In order to carry out appropriately adaptations of any program the teachers must have insight into their own teaching styles.

Lastly, these results extended the generalizeability of the previously reported research to include elementary pre-service and in-service science teachers. They also indicated that it may be necessary for future research on teacher beliefs and behaviors to consider teacher actions in a more global sense, as well as for science teacher education institutions to include modules in their curriculum that relate to relevant behaviors for these broad categorizations of science teachers.

TABLE 1

CORRELATIONS OF WEIGHTED
ITEM ARRAYS BY TYPE

Pre-Service Teacher Types	1	2	3	4
1	1.000	.804	.751	.824
2		1.000	.748	.816
3			1.000	.730
4				1.000

In-Service Teacher Types	1	2	3	4
1	1.000	.765	.536	.669
2		1.000	.427	.596
3			1.000	.320
4				1.000

TABLE 2

TYPE 1 PRE-SERVICE TEACHERS' BELIEFS
HIGHEST AND MOST DISTINCTIVE

Item No.	Item	TYPE Z-Score	Nearest Z-Score
18.	Teachers should use a lot of positive reinforcement in the classroom.	2.31	
50.	Teachers should create an atmosphere of emotional support.	2.02	
56.	Teachers should allow children to think for themselves.	1.91	
* * *

TABLE 3

TYPE 2 PRE-SERVICE TEACHERS' BELIEFS
HIGHEST AND MOST DISTINCTIVE

Item No.	Item	TYPE Z-Score	Nearest Z-Score
16.	Teachers should present well planned lessons.	1.83	
31.	Teachers should fit the curriculum to the child and not the child to the curriculum.	1.72	
54.	Teachers should let students discover ideas and solutions to problems.	1.62	
* * *

TABLE 4

TYPE 3 PRE-SERVICE TEACHERS' BELIEFS
HIGHEST AND MOST DISTINCTIVE

Item No.	Item	TYPE Z-Score	Nearest Z-Score
20.	Teachers should be attentive to and interested in all pupils.	1.95	
61.	Teachers should let students express their own ideas much of the time.	1.91	
18.	Teachers should use a lot of positive reinforcement in the classroom.	1.77	
* * *

TABLE 5

TYPE 4 PRE-SERVICE TEACHERS' BELIEFS
HIGHEST AND MOST DISTINCTIVE

Item No.	Item	TYPE Z-Score	Nearest Z-Score
34.	Teachers should let pupils be active in their own education.	2.04	
31.	Teachers should fit the curriculum to the child and not the child to the curriculum.	1.80	
56.	Teachers should allow children to think for themselves.	1.64	
	* * *

TABLE 6

TYPE 1 IN-SERVICE TEACHERS' BELIEFS

HIGHEST AND MOST DISTINCTIVE

Item No.	Item	TYPE Z-Score	Nearest Z-Score
34.	Teachers should let pupils be active in their own education.	1.96	
50.	Teachers should create an atmosphere of emotional support.	1.89	
54.	Teachers should let students discover ideas and solutions to problems.	1.79	
* * *

TABLE 7

TYPE 2 IN-SERVICE TEACHERS' BELIEFS

HIGHEST AND MOST DISTINCTIVE

Item No.	Item	TYPE Z-Score	Nearest Z-Score
46.	Teachers should view education as consisting mainly of arranging learning so that a child gradually builds up a system of knowledge he can use in the future.	1.90	
16.	Teachers should present well planned lessons.	1.77	
80.	Teachers should be good listeners.	1.77	

* * * *

TABLE 8

TYPE 3 IN-SERVICE TEACHERS' BELIEFS
HIGHEST AND MOST DISTINCTIVE

Item No.	Item	TYPE Z-Score	Highest Z-Score
50.	Teachers should create an atmosphere of emotional support.	2.27	
69.	Teachers should provide more guidance than answers.	1.99	
80.	Teachers should be good listeners.	1.74	

* * * *

TABLE 9

TYPE 4 IN-SERVICE TEACHERS' BELIEFS

HIGHEST AND MOST DISTINCTIVE

Item No.	Item	TYPE Z-Score	Nearest Z-Score
57.	Teachers should have the classroom contain many displays and interest centers.	4.46	
16.	Teachers should present well-planned lessons.	1.75	
18.	Teachers should use a lot of positive reinforcement in the classroom.	1.51	

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